SPECIAL REPORT 95-27

Silt Fence Testing for Eagle River Flats Dredging

Karen S. Henry and Susan T. Hunnewell

December 1995

Abstract

An estimated 1,000 to 2,000 waterfowl deaths have been noted annually since 1980 in Eagle River Flats (ERF), Alaska, an artillery impact area used by the Army. Waterfowl die because of the ingestion of unburned white phosphorus (WP) particles deposited by incendiary. Remediation of the site is currently being planned, and one of the techniques being considered is the use of a remote-control dredge to excavate WP-contaminated sediment. Dredged material will be placed into a settling pond and allowed to settle until a clear layer of water forms on the top of the sediments. The water will then be released over a weir, across a concrete pad, through a geotextile silt fence to a drain into the ERF. This report describes tests that were conducted to evaluate how well candidate geotextiles for the silt fence retained small particles (less than 0.1 mm in diameter) that were suspended in water being released back into the ERF. The soil used in the tests was collected from ponds to be dredged. The testing program consisted of two parts. Part I tests were standard engineering tests for silt fences, and were used to select a product for further testing. Part II tests simulated field conditions, and were conducted to determine whether the candidate geotextile selected was likely to perform well. In the tests that simulated field conditions, the tests that used geotextiles achieved system filtering efficiencies of 99%, and the geotextile filter reduced the final total suspended solids contained in the water by a factor of 10. Negligible amounts of soil passed the #200 sieve from water that flowed through the geotextile. However, it is also noted that allowing the sediment to settle before decanting the water resulted in system filtering efficiencies in excess of 90% when a silt fence was not used in the test. Due to differences between lab and field use of this product, several recommendations are made to help ensure the proper functioning of the geotextile when used in Eagle River Flats. These recommendations include monitoring the quantity of material with diameters larger than 0.1 mm passing through the silt fence, careful and frequent visual inspection of the silt fence to detect any signs of strength loss or damage, having replacement geotextile available and properly stored at the site, backflushing the silt fence with water or rubbing it with a squeegee regularly to help ensure proper flow rates across it, and not allowing the height of soil retained on the upstream side of the fence to exceed one-half of the height.

For conversion of SI units to non-SI units of measurement consult ASTM Standard E380-93, *Standard Practice for Use of the International System of Units,* published by the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103.

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US Army Corps of Engineers

Cold Regions Research & Engineering Laboratory

Silt Fence Testing for Eagle River Flats Dredging

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December 1995

Prepared for
U.S. ARMY GARRISON, ALASKA
and
U.S. ARMY ENVIRONMENTAL CENTER

PREFACE

This report was prepared by Karen S. Henry, Research Civil Engineer, and Susan T. Hunnewell, Civil Engineering Technician, Research and Engineering Directorate, U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

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Silt Fence Testing for Eagle River Flats Dredging

KAREN S. HENRY AND SUSAN T. HUNNEWELL

INTRODUCTION

Eagle River Flats (ERF) is an estuarine salt marsh on the Cook Inlet that has been used by the Army as an artillery impact area on Fort Richardson in Anchorage, Alaska, since 1949. It is also used by up to 5000 waterfowl per day during annual migrations (Racine et al. 1992). An estimated 1000 to 2000 waterfowl deaths have been noted annually in ERF since 1980. It was recently determined that ingestion of unburned white phosphorus (WP) particles deposited by smoke-producing incendiary is the primary cause of mortality (Racine et al. 1992). Waterfowl that circulate bottom sediment through their bills and retain food-sized particles for ingestion (e.g., dabbling ducks and swans) are the most susceptible (Racine et al. 1992). All firing of WP rounds into the ERF ceased in 1990 and remediation of the site is currently being planned; however, this area will continue to be used for other types of artillery impact during winter months when there is a solid ice cover.

One of the remediation techniques being considered for the ERF is the use of a remotely-controlled dredge to excavate WP-contaminated sediment. Dredged spoils, containing various-sized particles of WP, will be placed into a 90- by 90-m settling pond (or retention basin) with 2-m-high berms. There is a 7-m-wide × 1.2-m-high weir at one corner of the settling pond for the purpose of decanting water. The weir is fully adjustable in height, in increments of 3.8 cm. Spoils will be pumped into the basin, then allowed to settle until a clear layer of water forms on top of the sediments (a minimum of two hours). The water will then be released over the weir, across a 2-m-wide section of concrete pad, through a geotextile (referred to as a silt fence) and across the concrete pad to a drain into the ERF (Fig. 1 and 2). The

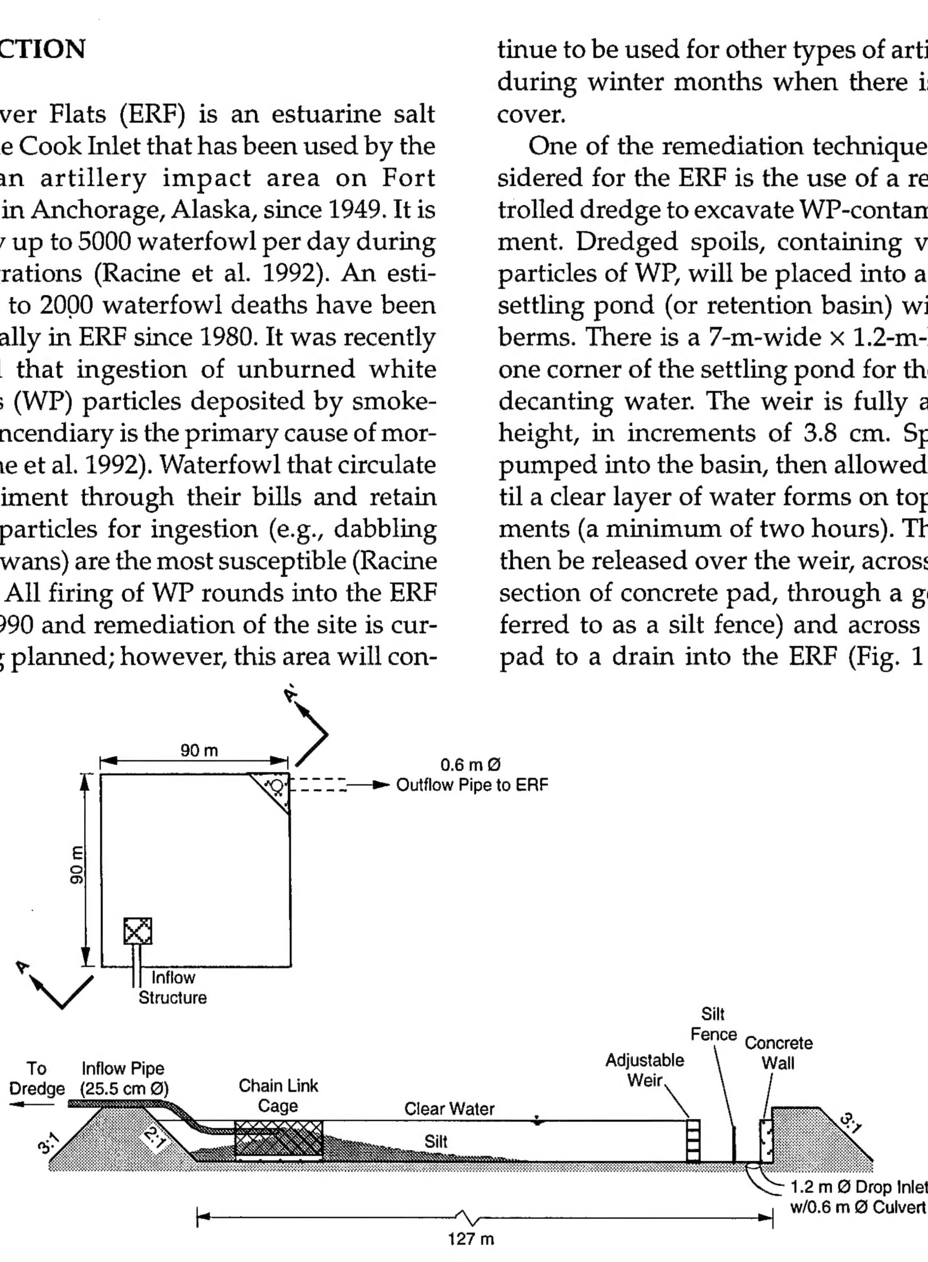

Figure 1. Plan view and cross section of the retention basin, with the inflow and outflow structures.

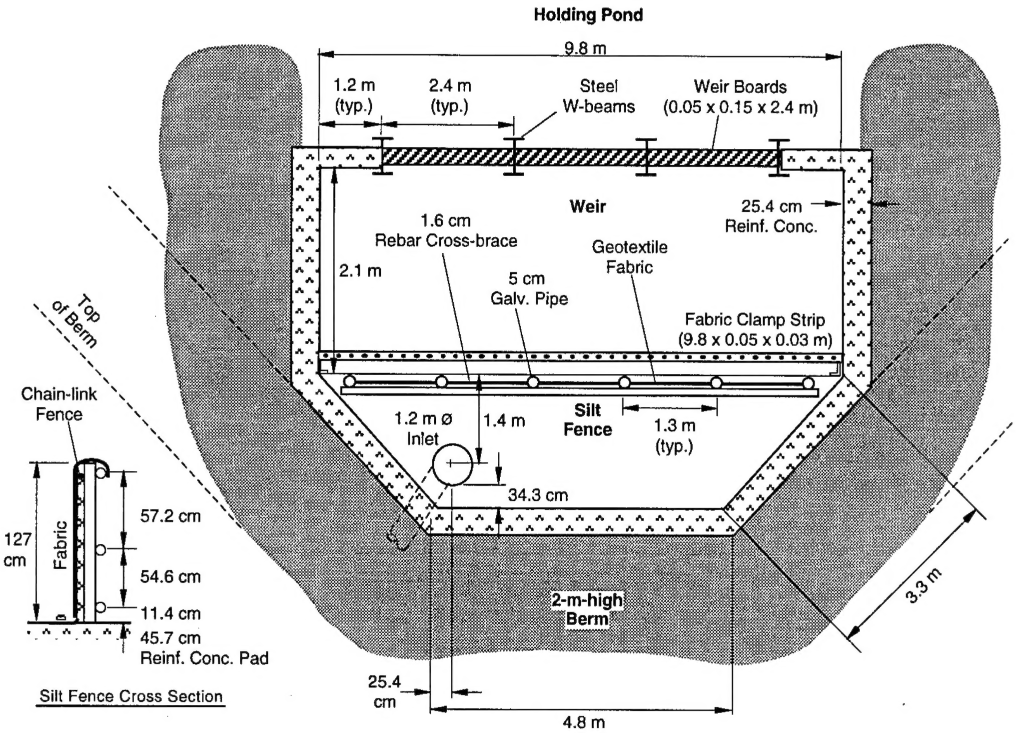

Figure 2. Plan view of weir–silt fence–outlet structure and cross section of the silt fence for the release of water from the settling pond for dredging operations in Eagle River Flats, Alaska.

water will flow over the weir with heads of 0.1 m or less in order to avoid reaching a flow rate that would significantly resuspend particles in the water being decanted. The silt fence is required as a backup mechanism to retain particles that are 0.1 mm in diameter and larger because WP particles of this size pose a significant threat to wildlife in Eagle River Flats. (The primary means of removing WP particles of this size is allowing the spoils to settle.) Once the dredged material is drained, it will be treated to remove WP. At this time, the specific remediation technique has not yet been determined. It will most likely involve heating and drying the sediment to volatilize the WP. Likewise, it is not yet known where the soil will be placed after treatment.

This report describes tests that were conducted to evaluate how well candidate geotextiles for the silt fence retained small particles that were suspended in water being released back into the ERF. Filtering efficiency, defined as the percentage of soil particles removed from sediment-laden water by a geotextile over a period of 25 minutes, was the main criterion evaluated (ASTM D 5141 1992). Some tests also included a measure of percent of soil retained (by weight) on the #200 sieve (mesh size of 0.075 mm) still contained in water filtered by the geotextile. The retention of particles of 0.1 mm and larger is the most important function of the geotextile in this application; therefore, selection of products for testing was limited to geotextiles with available apparent opening sizes* (AOS) of approximately 0.1 mm.

MATERIALS

The soil used in the laboratory test was collected from ponds to be dredged in Eagle River Flats, Alaska. It is primarily glacially derived silt; a typical grain size distribution of the soil to be dredged is shown in Figure 3 (Lawson and Brockett 1993). Table 1 lists the geotextiles tested along with properties of interest as provided by the manufacturers.

* Apparent opening size: A property that indicates the approximate largest particle diameter that would effectively pass through the geotextile.

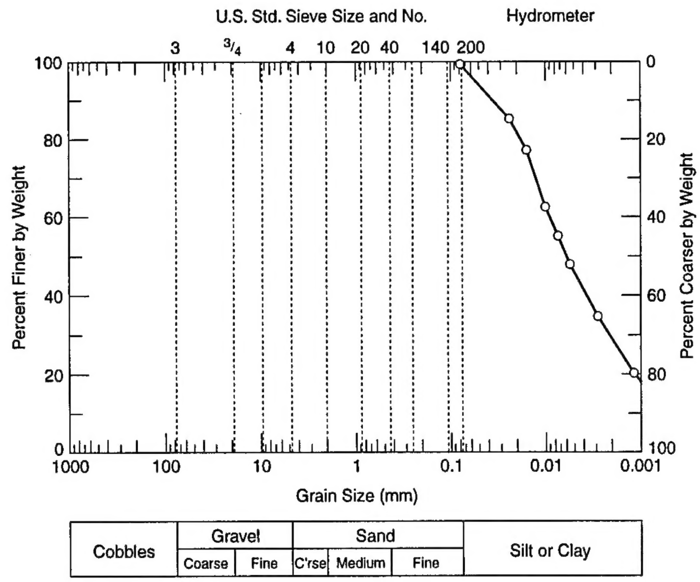

Figure 3. Typical grain size distribution for soil collected from pond bottom in Eagle River Flats, Alaska (from Lawson and Brockett 1993).

Table 1. Properties of geotextiles tested.

Geotextile	*Product*	*Construction*	*AOS*[1] *(mm)*	*Permittivity*[2] *(sec^{-1})*
A	Texel F-300	NW PET	0.04–0.05	0.31
B	Texel Geo 9	NW PET, reinforced	0.06–0.125	1.72
C	Amoco L17811	NW PP	0.075	not available
D	Amoco 4551	NW PP	0.150	1.9

[1] Apparent opening size: A property that indicates the approximate largest particle diameter that would effectively pass through the geotextile.
[2] Permittivity of geotextiles refers to the volumetric flow rate of water per unit cross-sectional area per unit head under laminar flow conditions, in the normal direction.

Notes: NW = nonwoven, PET = polyester, PP = polypropylene

PROCEDURE

The testing for this project consisted of two parts. Part I tests were conducted according to ASTM D 5141, *Standard Test Method for Determining Filtering Efficiency and Flow Rate of a Geotextile for Silt Fence Application Using Site-Specific Soil* (ASTM 1992). Thus, an accepted engineering standard was used to compare candidate geotextiles. Part II tests simulated field conditions, and were conducted to determine whether the candidate geotextile selected from the Part I tests was likely to perform well. Procedures followed in both experiments are included in Appendix A. Figure 4 is a diagram of the flume used for the tests, including a gate that was added for Part II tests.

Several means of sampling soil-laden water for total suspended solids (TSS) were tested before the start of the experimental program by mixing 150 g of dry soil with 500 mL of water in a laboratory blender before adding it to 49.5 L of water. (These are the amounts of soil and water recommended by ASTM D 5141.) The soil–water mixture was placed in a 0.5-m-diameter × 0.75-m-high plastic container, and vigorously stirred with a 0.25-m-wide paint stirrer attached to an electric drill. Samples were collected with a commercially available 250-mL-capacity water sampler while the water was still being agitated. This resulted in TSS determinations within 2% of the known TSS from the quantity of oven-dry soil added to the water. The PVC Coliwasa water sampler used is

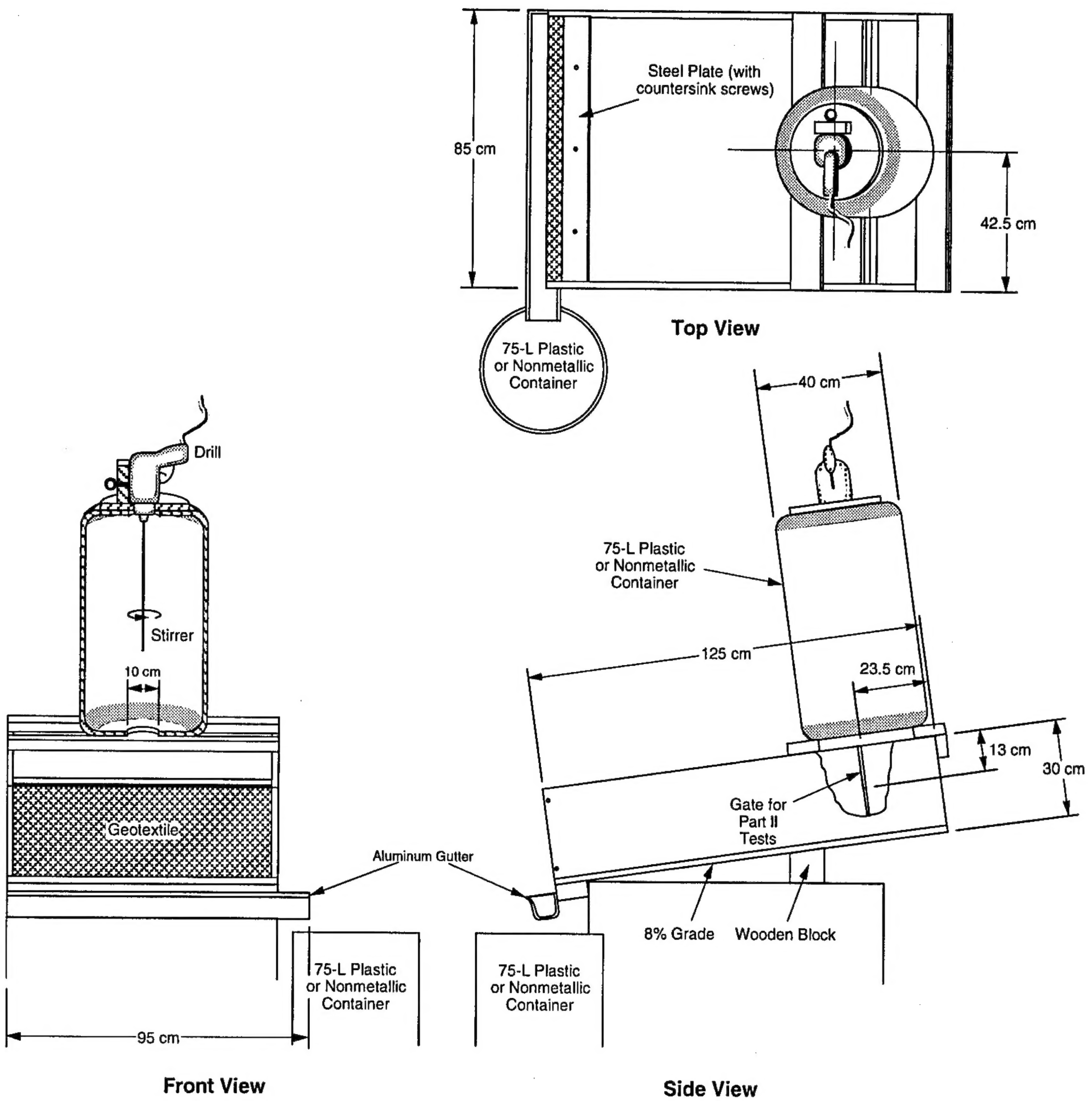

Figure 4. Diagram of flume used to conduct silt fence tests.

available from Forestry Suppliers, Inc., Jackson, Mississippi.

Part I

Twelve tests were conducted in Part I; there were three replications for each of four geotextiles, tested in random order. The initial TSS of the sediment-laden water released to the flume was either 2830 mg/L or 2880 mg/L, depending on how much rinse water was used after the mixture was released. The procedure described in ASTM D 5141 (1992) was followed, with three minor adjustments, listed below:

1) In order to break apart aggregated soil particles, the soil was mixed in a blender with 500 mL of water before being added to the rest of the water.
2) The soil–water mixture was released into the flume immediately after one minute of agitation (i.e., agitation was not continued during the release).
3) Rather than taking one depth-integrated sample, three samples of soil-laden water using a PVC Coliwasa water sampler were taken and analyzed independently for TSS. Each sample was approximately 50 mL.

In test 2, the back of the geotextile was scraped with a spoon about 15 minutes after the test was begun and a significant increase in the instantaneous flow rate of water through the geotextile was noted. This procedure probably resulted in an increased amount of sediment passing through the geotextile and is discussed further in a later section.

Part II

Part II test conditions simulated field use of the silt fence. The soil–water mixture had a TSS value equal to the expected maximum TSS of the dredged material. The mixture was made with brackish water, then allowed to settle before releasing the top layer of relatively clear water. Six tests were conducted: three without a geotextile and three using geotextile B.

Following is a list of the changes made to the ASTM procedure for Part II tests:

1) The TSS of the soil–water mixture was 2.0×10^5 mg/L (67 times that prescribed by ASTM D 5141 1992) and the salinity of the water used was 4.5 ppt (vs. fresh water).
2) A 28-cm-high impermeable gate was installed 23.5 cm from the back of the flume to allow the soil to settle out of the mixture. The top 13 cm of the gate was removable to allow decantation in a manner similar to the lowering of the weir on the settling pond. These changes were implemented as follows:

   For the first test, the soil–water mixture was released from the top container into the back of the flume. It consisted of 46.6 L of water, 233 g of sea salt, and 9248 g of oven-dry soil. This mixture settled until there was a clear water/sediment interface located 5 cm below the removable portion of the gate (approximately two hours). The test was conducted by quickly lifting the top portion of the gate and releasing the upper layer of water all at once.

   Due to lack of soil and time, it was not desirable to remake the entire 50 L of soil–water mixture for the second, third, and fourth tests. Therefore, the amount of soil and water lost in the first test was determined* (222.0 g and 24.0 L, respectively, with a salt content of 111.7 g), then added to the soil and water that had remained behind the gate. The entire soil–water mixture was stirred vigorously by hand for one minute. After stirring, the soil–water mixture was allowed to settle until the soil/water interface reached a level of 5 cm below the removable portion of the gate. Then the next test was conducted.
3) The flume was set at a 1% (vs. 8%) grade to simulate the slope of the dredged material being deposited from a 1-m-high dredge outlet pipe located 125 m from the weir.
4) At about eight minutes and 16 minutes after the water mixture was released, the downstream side of the geotextile was scraped with a spatula to increase the water flow through the geotextile. A practice like this will be performed in the field in order to maintain water flow through the silt fence as long as possible. The silt fence will either be backflushed with water or scraped with a long-handled squeegee.
5) After the TSS samples were collected, the remaining soil–water mixture was poured through a #200 sieve (0.075-diameter opening size) so that the effectiveness of the geotextile in retaining particles of 0.1 mm and larger could be estimated.

* This was calculated by averaging the total suspended solids found in the three samples and multiplying by the volume of water lost.

RESULTS

A complete list of results from Parts I and II is included in Appendix B. The filtering efficiency is defined as the percentage of soil particles retained by the silt fence. The "system filtering efficiency" in Part II tests was determined analogously by comparing the final TSS of the sediment-laden water (whether or not a geotextile was present) to the original TSS of the water allowed to settle in the back of the flume.

Parts I and II

Table 2 is a summary of Part I results. Christopher and Holtz (1985) recommend a minimum filtering efficiency of 75% and flow rate of 0.012 $m^3 m^{-2} min^{-1}$. Geotextiles A and B performed relatively well, and geotextiles C and D performed poorly. However, only geotextile B was selected for further study, because it had the desirable characteristic of being reinforced and because the time required to perform the Part II tests was limited.

Table 3 summarizes the results from Part II. The tests that used geotextiles achieved system filtering efficiencies of 99%, and the geotextile filter reduced the final TSS values by a factor of 10. The "average effective filtering efficiency" for the geotextile, determined by comparing the final TSS values for the geotextile tests to those from the tests without geotextiles, was 89%.

Comparing the final TSS measurements of tests 3 and 7 with test 1 in Table 3 suggests that the

Table 2. Summary of Part I results.

Test no.	*Material*	*Flow rate (m^3m^{-2} min^{-1})*	*Average flow rate*	*Standard deviation flow rate*	*FE (%)*	*Average FE FE (%)*	*Standard deviation FE*
1	A	0.026			71.40		
5	A	0.026	0.026	3.9E–6	66.69	69.6	2.5
9	A	0.026			70.56		
6	B	0.026			76.11		
11	B	0.026	0.026	2.8E–4	73.38	72.8	3.7
12	B	0.026			68.82		
4	C	0.026			54.38		
7	C	0.026	0.026	8.0E–5	61.08	58.7	3.7
8	C	0.026			60.52		
2	D	0.026			39.19		
3	D	0.026	0.026	2.9E–5	48.33	45.5	5.5
10	D	0.026			48.89		

Note: FE = filtering efficiency

Table 3. Summary of Part II results.

Test no.	*Geotextile?*	*Flow rate (m^3m^{-2} min^{-1})*	*Final TSS (mg/L)*	*FE of system (%)*	*Percent retained on #200 sieve*
1	No		9249	95.3	did not measure
3	No		6360	96.8	1
7	No		14466	92.7	3
2	Yes	0.063	654	99.7	< 0.1
4	Yes	0.024	1185	99.4	< 0.1
6	Yes	0.120	1465	99.3	did not measure

practice of not mixing the soil and water in a blender for each test in Part II did not significantly influence the TSS measurements of the soil–water mixture.

DISCUSSION

Overview of test results

In all tests using geotextiles, the water flow rate through the material slowed with time. This probably happened because the sediment-laden water flowing through the geotextile formed a filter cake of soil particles on the upstream side (LaFleur 1994, personal communication*). In test 2 of Part I, the downstream side of the geotextile was scraped with a spoon about 15 minutes after the test was begun and a significant increase in the instantaneous flow rate of water through the geotextile—thought to be due to the destruction of the filter cake—was noted. The lower filtering efficiency of this test compared to the other tests with the same geotextile suggests that scraping the downstream side of the geotextile during the test increased the amount of soil that passed through it. The Part II test procedure incorporated scraping the downstream side of the geotextile because similar techniques will be used in the field to promote increased water flow rate across it.

For the Part II tests, the TSS values from tests without geotextiles were used to estimate the TSS content of water that reached the geotextile. This TSS value was approximately 3.5 times that of the TSS of the water used in the Part I tests (10,025 mg/L vs. 2880 mg/L). However, the flow rates of the Part I and Part II tests with geotextiles were similar. This most likely resulted from the practice of scraping the geotextile in Part II.

Part II test results clearly show the importance

* J. LaFleur, Professor of Civil Engineering, École Polytechnique, Montreal, Quebec, Canada.

of allowing the dredged sediment to settle before decanting water. This alone resulted in system filtering efficiencies in excess of 90%.

In tests 2 and 4 of Part II, a small fraction of soil was retained on the #200 sieve from the water that flowed through the geotextile. Since the geotextile also had the effect of reducing the final amount of TSS in the water by a factor of 10, the percentage of soil with a minimum diameter of 0.1 mm was clearly negligible when the geotextile filtered the suspension. The Part II results also clearly demonstrate the importance of allowing the spoils to settle before decanting the water. This practice resulted in system filtering efficiencies in excess of 90%.

Applying laboratory test results to the field use of the silt fence

The estimated velocity of flow over a weir is

$$V = \sqrt{2gh} \tag{1}$$

where V is the velocity of the water flow, g is the acceleration of gravity, and h is the head of the water on the weir (Roberson and Crowe 1975). Because the head of water on the weir was the same in the laboratory as expected in the field, the initial flow rates over the weir in the field and the gate in the laboratory are approximately equal. In the field, the velocity of water flow through the silt fence might be somewhat less due to effects of end contractions on the weir, turbulence created when water falls onto the concrete pad, and friction drag from the concrete pad as the water flows over it. However, the length of time that the water is flowing at relatively high velocities will probably be longer than that experienced in the laboratory test. Thus, there are unquantified differences in water flow rates and time of water flow between the laboratory and the field that could have opposite effects on the long-term filtering efficiency of the silt fence. Therefore, the quantity of material with diameters larger than 0.1 mm passing through the silt fence should be monitored in the field to ensure that the silt fence is performing as intended.

Geosynthetics are known to experience strength degradation when exposed to ultraviolet light for more than a few days. When left exposed for periods of about a year, material loss has also been observed. Koerner (1990) noted that standard specifications for geotextile silt fences require that a minimum of 70% of the original tensile strength remain after exposure to ultraviolet radiation according to ASTM D 4355 (1992). Although most geotextiles have some ultraviolet stabilizing additives incorporated during manufacture, the results of ASTM D 4355 (1992) are not available for geotextile B. Furthermore, geotextile B is usually used for some combination of reinforcement, separation, and stabilization, i.e., in situations where it is exposed to sunlight for only a short time during construction (Geotechnical Fabrics Report 1993). Thus, the silt fence should be carefully monitored during use, and replacement material should be readily available and properly stored at the site in the event that unacceptable strength degradation of the material occurs.

CONCLUSION

Among the four geotextiles tested, geotextile B is the best geosynthetic candidate available to perform the filtering of WP particles in ERF. It effectively retained particles of 0.075 mm and larger.

RECOMMENDATIONS

The following recommendations are made to help ensure the proper functioning of geotextile B as a silt fence in Eagle River Flats:

1. The quantity of material with diameters larger than 0.1 mm passing through the silt fence should be monitored during field operation.
2. The silt fence should be carefully visually inspected frequently to detect any signs of strength loss due to ultraviolet degradation or other damage.
3. Replacement geotextile should be readily available and properly stored at the site. Proper storage includes wrapping in black plastic and storing in a dry area indoors where it is not exposed to freezing temperatures.
4. The silt fence should be backflushed with water or rubbed with a squeegee regularly to help ensure proper flow rates across it.
5. According to Christopher and Holtz (1985), soil retained on the upstream side of the silt fence should never exceed one-half the height of the fence (0.6 m) due to the potential danger of water overtopping the fence. Thus, if soil buildup behind the fence reaches this height, it should be removed.

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APPENDIX A: STEP-BY-STEP TEST PROCEDURES USED IN LABORATORY SILT FENCE TESTS FOR EAGLE RIVER FLATS, ALASKA

Silt fence test procedure (from ASTM standard D 5141)

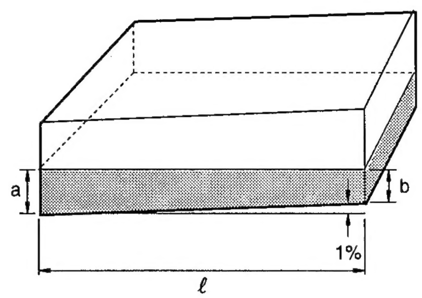
1. Set flume at an 8% grade.
2. Fasten geotextile across flume opening. Be sure there are no wrinkles or loose sections.
3. Wet the geotextile with 50 L of tap water.
4. Determine the water content of the soil, and weigh out 150 grams of dry soil. Record weight of the soil.
5. Mix the soil in the blender with 500 mL of water: 10 seconds on low, 10 seconds on high. Add the mixture to tap water to make 50 L of soil and water in the top container.
6. Agitate the mixture with the stirrer (paint stirrer on drill) for one minute.
7. Immediately after stirring, release the mixture. Release should take less than 10 seconds. **Start timer at release!**
8. Rinse the mixing container with 2–3 L of water. **Record the total amount of water used.** Calculate initial TSS based on the 150 g of soil and the total volume of water.
9. Time the flow of water through the geotextile until no water remains behind the geotextile or 25 minutes have elapsed. If 25 minutes elapse, measure the distance from the geotextile to the edge of the water behind the geotextile. Record the time of flow and the distance, if appropriate.
10. Collect all of the mixture in a container.
11. Agitate the mixture with the stirrer for one minute.
12. After one minute of stirring, obtain a depth-integrated sample while continuing to stir the mixture. Record the volume of the sample taken.
13. Repeat steps 11 and 12 until three samples have been obtained.
14. Determine the TSS of the three samples according to ASTM D 5141.

Silt fence tests for site-specific conditions

1. Set flume at a 1% grade, and ensure that the top of the vertical barrier, located 23.5 cm from the back of the flume, is fastened in place.
2. Mix 9248 g of dry soil collected from ERF ponds in 46.6 L of water. The water should have a salinity of 4.5 ppt, and the soil should be mixed in a blender with the water. The entire mixture should be stirred for one minute and released to the flume. (Note that this is a mixture of 16.7% by volume of soil in water.)
3. Let the mixture stand in the back of the flume until a clear layer of water, 13 cm high, forms. This will take about two hours.
4. Remove (all at once) the top portion of the vertical barrier in the flume.
5. Catch all of the water and sediment in a large container. At about eight minutes and 16 minutes after release of the water, scrape the downstream side of the geotextile with a spoon to induce water flow through it. After 25 minutes, stir the water and material in the container for one minute and take three depth-integrated samples. Note that the gutter may have to be cleaned out first.
6. Determine TSS on the three samples according to ASTM D 5141.

APPENDIX B: RESULTS OF SILT FENCE TESTING FOR EAGLE RIVER FLATS, ALASKA, JULY AND AUGUST 1994

Note that for the Part II tests containing geotextiles, the flow rates were determined by calculating the volume of water and soil left behind the fence at 25 minutes, then subtracting that from $0.05\ m^3$ (50 L), the initial volume of water and soil. The parameters and equation used to determine the volume of soil and water left at the end of 25 minutes are defined in the figure below:



Volume ≈ $(a \cdot \ell \cdot w) - (1/2 \cdot \ell \cdot (a-b) \cdot w)$

Figure B-1. Sketch of flume, defining the variables used to estimate the volume of water in the flume remaining after 25 minutes. Variables a and b were both measured.

Final Results:

ASTM Silt Fence Experiments

Part I tests:

Test #	Geotextile	Distance of water behind geotextile at 25 min. (m)	initial TSS (mg/L)	final TSS avg. (mg/L)	FE (%)	avg. FE (%)	Std. dev. flow rate	Flow Rate (m^3/m^2-min)	Flow Rate Corrected for Temp.	avg. Flow Ave. flow rate	Std. dev. flow rate
1	A-1	1.0414	2830	809.3	71.40			0.0269	0.02585		
5	A-2	1.0414	2880	959.4	66.69	69.55	2.51	0.0269	0.02585	0.02586	3.87E-06
9	A-3	1.0541	2880	848	70.56			0.0269	0.02586		
6	B-1	1.13665	2880	688.1	76.11			0.0270	0.02590		
11	B-2	1.13665	2880	766.7	73.38	72.77	3.68	0.0270	0.02644	0.02613	0.000281
12	B-3	1.1303	2880	898.1	68.82			0.0270	0.02604		
4	C-1	1.1176	2830	1291	54.38			0.0270	0.02589		
7	C-2	1.1176	2880	1121	61.08	58.66	3.72	0.0270	0.02603	0.02599	7.99E-05
8	C-3	1.1303	2880	1137	60.52			0.0270	0.02604		
2	D-1	0.83185	2830	1721	39.19			0.0268	0.02574		
3	D-2	0.9017	2880	1488	48.33	45.47	5.45	0.0269	0.02578	0.02577	2.89E-05
10	D-3	0.9398	2880	1472	48.89			0.0269	0.02580		

Part II tests: (initial TSS assumed to be 198,455 mg/L in all tests)

Test #	Geotextile	final TSS (mg/L)	FE (%)	Flow Rate (m^3/m^2 min)	Avg. Flow Rate (m^3/m^2 min)
1	No	9249	95.3	not applicable	
3	No	6360	96.8	not applicable	
7	No	14466	92.7	not applicable	
2	Yes	654	99.7	0.0063	
4	Yes	1185	99.4	0.0024	0.0069
6	Yes	1465	99.3	0.0120	

Flow rates for Part II tests:

Test #	a(m)	b(m)	(a-b)	Volume m^3	Flow Rate (m^3/m^2 min)
2	0.022225	0.006635	0.01559	0.011993819	0.0063
4	0.00871	0.002381	0.006329	0.004609267	0.0024
6	0.035	0.02	0.015	0.022857244	0.0120

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13. ABSTRACT (*Maximum 200 words*)

An estimated 1,000 to 2,000 waterfowl deaths have been noted annually since 1980 in Eagle River Flats (ERF), Alaska, an artillery impact area used by the Army. Waterfowl die because of the ingestion of unburned white phosphorus (WP) particles deposited by incendiary. Remediation of the site is currently being planned, and one of the techniques being considered is the use of a remote-control dredge to excavate WP-contaminated sediment. Dredged material will be placed into a settling pond and allowed to settle until a clear layer of water forms on the top of the sediments. The water will then be released over a weir, across a concrete pad, through a geotextile silt fence to a drain into the ERF. This report describes tests that were conducted to evaluate how well candidate geotextiles for the silt fence retained small particles (less than 0.1 mm in diameter) that were suspended in water being released back into the ERF. The soil used in the tests was collected from ponds to be dredged. The testing program consisted of two parts. Part I tests were standard engineering tests for silt fences, and were used to select a product for further testing. Part II tests simulated field conditions, and were conducted to determine whether the candidate geotextile selected was likely to perform well. In the tests that simulated field conditions, the tests that used geotextiles achieved system filtering efficiencies of 99%, and the geotextile filter reduced the final total suspended solids contained in the water by a factor of 10. Negligible amounts of soil passed the #200 sieve from water that flowed through the geotextile. However, it is also noted

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13. ABSTRACT (*cont'd.*)

that allowing the sediment to settle before decanting the water resulted in system filtering efficiencies in excess of 90% when a silt fence was not used in the test. Due to differences between lab and field use of this product, several recommendations are made to help ensure the proper functioning of the geotextile when used in Eagle River Flats. These recommendations include monitoring the quantity of material with diameters larger than 0.1 mm passing through the silt fence, careful and frequent visual inspection of the silt fence to detect any signs of strength loss or damage, having replacement geotextile available and properly stored at the site, backflushing the silt fence with water or rubbing it with a squeegee regularly to help ensure proper flow rates across it, and not allowing the height of soil retained on the upstream side of the fence to exceed one-half of the height.